



June 18, 2004

Mr. Alan Rawson
Administrator, Materials & Research
New Hampshire Dept. of Transportation
11 Stickney Ave.
Concord, NH 03301

RE: Eastern States Consortium Split Sample Comparative Sample Evaluation

Dear Alan:

Per the requirements specified in the Eastern States Consortium Program please accept this submittal as documentation of the split sample comparative sample evaluations that were conducted on the samples submitted from our Ludlow, Massachusetts plant.

If you have any questions concerning the attached documents please do not hesitate to call me direct at (513) 896-2065. It has been a pleasure working with you and the other Eastern States Consortium members as we implement this program.

Sincerely,

A handwritten signature in black ink, appearing to read "Terry McElfresh", with a stylized flourish at the end.

Terry McElfresh
Quality Control Manager

CC: B. Slicker
D. Hall

/lkw



THE MOST ADVANCED NAME IN DRAINAGE SYSTEMS



**RE: TESTING OF (3) SAMPLES OF LUDLOW 450 MM (18") DIAMETER
SMOOTHWALL TYPE 'S' POLYETHYLENE PIPE TO AASHTO
M294M-03 FOR THE ESC PROGRAM**

CONDITIONING: Not less than 40 hours at $23 \pm 2^{\circ} \text{C}$ (73°F)

TEST RESULTS:

SECTION 6.1 BASIC MATERIALS

Results:

	DENSITY (g/cm ³)	MELT INDEX (g/10 minutes)	CARBON
TRI/Environmental	0.950	0.29	2.56
ADS	0.952	0.23	2.16

SPECIFICATION: Minimum Cell Class 335400C and SP-NCTL 15% 24hours.
Density .945 to .955 g/cm³
Melt index 0.15 to 0.40 g/10 min.
Carbon Black Content 2% minimum / 5% Maximum
*Compounds that have a higher cell classification in one or more properties with the exception of density are acceptable provided product requirements are met.

CONCLUSION: Specification is met.

SECTION 7.1 WORKMANSHIP

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: Free of foreign inclusions and visible defects. Inner liner shall be fused to outer corrugated wall at all internal corrugation crests.

CONCLUSION: Specification is met.

SECTION 7.2 PIPE DIMENSIONS

SECTION 7.2.2 WALL THICKNESS

	INNERWALL THICKNESS
TRI/Environmental	0.074"
ADS	0.067"

SPECIFICATION: The minimum inner wall thickness requirement is 1.3 mm (0.051 in)

CONCLUSION: Specification is met.

SECTION 7.2.3 INSIDE DIAMETER

	INSIDE DIAMETER
TRI/Environmental	18.00"
ADS	18.06"

SPECIFICATION: Nominal inside diameter shall not exceed 4.5% oversize or 1.5% undersize and not more than 30mm oversize.
410 – 443mm (17.45" –18.51")

CONCLUSION: Specification is met.

SECTION 7.4 PIPE STIFFNESS

	ORIENTATION	PIPE STIFFNESS
TRI/Environmental	0 / 45 / 90	41 / 42 / 42
ADS	0 / 45 / 90	45 / 44 / 44

SPECIFICATION: The minimum pipe stiffness requirement at 5% deflection is 275 kPa. (40 PSI)

CONCLUSION: Specification is met.

SECTION 7.5 PIPE FLATTENING

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATIONS: There shall be no evidence of bucking, cracking, splitting or delamination when the vertical inside diameter is reduced by 20%.

CONCLUSION: Specification is met.

SECTION 7.6 ENVIRONMENTAL STRESS CRACKING

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: There shall be no cracking of the pipe.

CONCLUSION: Specification is met.

SECTION 7.7 BRITTLENESS

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: The pipe specimens shall not crack or split.
Five non-failure out of six impacts will be acceptable.

CONCLUSION: Specification is met.

SECTION 7.8 FITTING REQUIREMENTS

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: Pipe connections shall not separate to create a gap exceeding 5 mm. (0.197") when measured between the bell and spigot portions of pipe fittings shall not crack or delaminate.

SECTION 11 MARKING

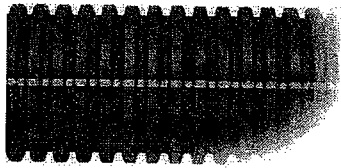
Sample	MFG.	SIZE	PLANT CODE	PRODUCTION DATE
TRI/Environmental	ADS	18" 450mm	L (Ludlow)	N/A
ADS	ADS	18" 450mm	L (Ludlow)	02/04/04

SPECIFICATION: Pipe and fitting shall be marked at intervals not more than 3.5m, manufacturer's name or trademark, nominal size, AASHTO M294M, plant code and date of manufacture or appropriate code.

CONCLUSION: Specification is met.



Terry McElfresh
Quality Control Manager



THE MOST ADVANCED NAME IN DRAINAGE SYSTEMS



**RE: TESTING OF (3) SAMPLES OF LUDLOW 750 MM (30") DIAMETER
SMOOTHWALL TYPE 'S' POLYETHYLENE PIPE TO AASHTO
M294M-03 FOR THE ESC PROGRAM**

CONDITIONING: Not less than 40 hours at $23 \pm 2^{\circ} \text{C}$ (73°F)

TEST RESULTS:

SECTION 6.1 BASIC MATERIALS

Results:

	DENSITY (g/cm ³)	MELT INDEX (g/10 minutes)	CARBON
TRI/Environmental	0.950	0.29	2.54
ADS	0.952	0.24	2.19

SPECIFICATION: Minimum Cell Class 335400C and SP-NCTL 15% 24hours.
Density .945 to .955 g/cm³
Melt index 0.15 to 0.40 g/10 min.
Carbon Black Content 2% minimum / 5% Maximum
*Compounds that have a higher cell classification in one or more properties with the exception of density are acceptable provided product requirements are met.

CONCLUSION: Specification is met.

SECTION 7.1 WORKMANSHIP

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: Free of foreign inclusions and visible defects. Inner liner shall be fused to outer corrugated wall at all internal corrugation crests.

CONCLUSION: Specification is met.

SECTION 7.2 PIPE DIMENSIONS

SECTION 7.2.2 WALL THICKNESS

	INNERWALL THICKNESS
TRI/Environmental	0.108"
ADS	0.103"

SPECIFICATION: The minimum inner wall thickness requirement is 1.5 mm (0.059 in)

CONCLUSION: Specification is met.

SECTION 7.2.3 INSIDE DIAMETER

	INSIDE DIAMETER
TRI/Environmental	29.90"
ADS	29.88"

SPECIFICATION: Nominal inside diameter shall not exceed 4.5% oversize or 1.5% undersize and not more than 30mm oversize.
739 – 780mm (29.08" –30.70")

CONCLUSION: Specification is met.

SECTION 7.4 PIPE STIFFNESS

	ORIENTATION	PIPE STIFFNESS
TRI/Environmental	0 / 45 / 90	43 / 43 / 39
ADS	0 / 45 / 90	42 / 42 / 38

SPECIFICATION: The minimum pipe stiffness requirement at 5% deflection is 195 kPa. (28 PSI)

CONCLUSION: Specification is met.

SECTION 7.5 PIPE FLATTENING

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATIONS: There shall be no evidence of bucking, cracking, splitting or delamination when the vertical inside diameter is reduced by 20%.

CONCLUSION: Specification is met.

SECTION 7.6 ENVIRONMENTAL STRESS CRACKING

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: There shall be no cracking of the pipe.

CONCLUSION: Specification is met.

SECTION 7.7 BRITTLENESS

	RESULTS
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: The pipe specimens shall not crack or split.
Five non-failure out of six impacts will be acceptable.

CONCLUSION: Specification is met.

SECTION 7.8 FITTING REQUIREMENTS

	RESULTS
TRI/Environmental	Pass
ADS	Pass

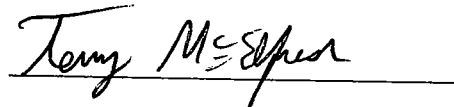
SPECIFICATION: Pipe connections shall not separate to create a gap exceeding 5 mm. (0.197") when measured between the bell and spigot portions of pipe fittings shall not crack or delaminate.

SECTION 11 MARKING

	MFG.	SIZE	PLANT CODE	PRODUCTION DATE
TRI/Environmental	ADS	30" 750mm	L (Ludlow)	N/A
ADS	ADS	30" 750mm	L (Ludlow)	02/04/04

SPECIFICATION: Pipe and fitting shall be marked at intervals not more than 3.5m, manufacturer's name or trademark, nominal size, AASHTO M294M, plant code and date of manufacture or appropriate code.

CONCLUSION: Specification is met.



Terry McElfresh
Quality Control Manager